

DATE: March 31, 1998

TO: Office of Water Programs Staff

THRU: Eric H. Bartsch, P.E., Director
Office of Water Programs

FROM: Allen R. Hammer, P.E., Director
Division of Water Supply Engineering

SUBJECT: Water - Design - Cross Connection Control

DELETE: Working Memos 407, 413, and 479

RE: *Waterworks Regulations* 12 VAC 5-590-580 through 12 VAC 5-590-630
Working Memo 276 - Interaction with Board of Housing and Community Development
International Plumbing Code Section 609 - Protection of Potable Water Supply

I. General

This working memo addresses the role of the Office of Water Programs in cross connection and backflow prevention regulation. Jurisdictional boundaries, minimum program requirements (including model programs and ordinances), and specific requirements or guidance for specific field conditions will all be addressed.

II. Jurisdictional Issues

- A. Containment Policy.** The primary regulatory responsibility and goal of OWP with respect to cross connection control is the statewide implementation of the containment policy established by the *Waterworks Regulations* (12 VAC 5-590-610). All related OWP policy and official acts (including field investigations, communications, training activities, etc.) are based on achieving this goal. The primary method of achieving this goal is the required local program (12 VAC 5-590-600) supported by local ordinance (for governmental entities).
- B. Building Officials.** The *Uniform Statewide Building Code (USBC)*, in this case the *International Plumbing Code*, governs the installation of all plumbing in buildings or on the premises of buildings. Backflow prevention devices shall be installed at the service connection to a consumer's water supply system (building plumbing) where a health hazard to the waterworks exists. Most conflicts between USBC and *Waterworks Regulations* concerning cross connection control best practices have been eliminated with the *International Plumbing Code*. This includes all aspects of the building drinking water and fire protection systems beyond any required containment devices. Some Virginia municipalities have adopted the *Building Maintenance Code* which allows them to selectively enforce maintenance requirements such as cross connection control. Enforcement of all building code requirements is through the local building official. A good working relationship with local building officials within the district service area is essential to OWP District Engineers.

NOTE: It is the policy of OWP to not get involved in the assessment of appropriate backflow prevention devices at water outlets inside a building. This area is the legal responsibility of the building official. When an OWP engineer or inspector discovers an inappropriate or improper installation, their obligation is to point this situation out to the appropriate waterworks owner and building official for their action. When specifically asked by a waterworks owner or building official for an opinion about adequate protection at a water

outlet inside a building, the OWP engineer or inspector may respond with their professional opinion about the situation stressing that it is not the opinion or policy of OWP.

- C. **Unusual Conditions.** When special or unique conditions make location of the containment device at the service connection impractical, the device may be located downstream of the service connection but prior to any unprotected branches (12 VAC 5-590-610 B). When such situations occur, it is essential that proper communication takes place between the waterworks owner, the building official, and the consumer or building owner. Direct OWP participation in the decision making of each such situation is not needed.
- D. **Governmental Waterworks Owners.** There are a multitude of local government organizational arrangements to address cross connection control. This is especially the case when the local government is both a waterworks owner and a building official. How local government organizes their internal programs is strictly their business. OWP is committed to working with the appropriate designated local officials.
- E. **Joint Responsibility for Water Quality.** Water quality at the tap is the joint responsibility of OWP, the building official, the waterworks owner, and the consumer (building or facility owner). Mutual education and communication between these parties are essential. Due to our special knowledge and understanding of the technical and public health aspects of cross connection control, OWP must take the lead in assuring that adequate education and communication are taking place.

III. Cross Connection Control Programs (12 VAC 5-590-600 B 1).

- A. **Program Purpose and Priority.** Preventing backflow of contaminants into the waterworks from a consumer's water supply system is the primary purpose of a waterworks cross connection control program. Containment has the highest priority.
- B. **Consumer Protection.** Preventing backflow of contaminants into the consumer's water supply system is the secondary purpose or priority of a program. Informing the consumer or building owner of the shared responsibility for water quality, and providing assistance in recommending appropriate backflow prevention devices or separations at each point-of-use beyond the service connection should be a part of a good program.
- C. **Implementation Priorities.** Publicly owned buildings and those facilities listed in 12 VAC 5-590-610E. of the *Waterworks Regulations* should be first priority.
- D. **Substitution of Isolation for Containment.** In situations where the internal building plumbing is not intricate or complex, a good program should recognize that it may be more cost-effective to use point-of-use backflow prevention to **isolate** in lieu of **contain** the potential cross connection. Access for follow-up inspections would be necessary. These decisions are at the discretion of the waterworks owner. The waterworks owner always has the option to require a containment device.
- E. **Degree of Hazard (12 VAC 5-590-620).** The type of protection required shall depend on the degree of hazard which exists or may exist. The degree of hazard, either high, moderate, or low is based on the nature of the contaminants; the potential health hazard; the probability of the backflow occurrence; the method of potential backflow either by backpressure or by backsiphonage; and the potential effect on waterworks structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of pure water. Table 2.10 of the *Waterworks Regulations* shall be used as a guide to determine the degree of hazard for any situation.

Atmospheric vacuum breakers (AVB) and pressure vacuum breakers (PVB) are generally not considered containment devices.

A double gate - double check valve assembly shall not be used as a containment device in high hazard situations.

Backflow prevention by separation shall be an air gap or physical disconnection. The minimum air gap shall be twice the effective opening of a potable water outlet unless the outlet is a distance less than three times the effective opening away from a wall or similar vertical surface, in which case the minimum air gap shall be three times the effective opening of the outlet. In no case shall the minimum air gap be less than one inch.

Backflow prevention devices with openings, outlets, or vents that are designed to operate or open during backflow prevention shall not be installed in pits or areas subject to flooding.

- F. Approved Containment Devices.** Containment devices under the jurisdiction of the *Waterworks Regulations* (12 VAC 5-590-620) are those which meet AWWA standards, hold ASSE approval, and have an approval from the University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USC). USC Foundation members are kept up to date on approvals. Otherwise, the supplier or manufacturer can supply approval documentation. NOTE: USC device approval is specific to orientation, horizontal or vertical, device model number and size. Approvals are continuously verified and can be rescinded.

Devices either under the jurisdiction of the *USBC* or used in situations where voluntary point-of-use isolation protection is used in lieu of a service line containment device must, as a minimum, have the American Society of Sanitary Engineers (ASSE) seal attached to, or stamped on, the device.

Both of the above approvals are contingent upon the proper installation and application of the device (see attached table, Isolation Device Application). Generally, containment devices addressed in this memo would include reduced pressure principle backflow prevention devices (RPZ) and double gate-double check valve assemblies (DG-DC). The USC has specifications for AVB, PVC and spill resistant PVB and approves these devices for containment. Their use as containment devices is generally limited to lawn irrigation systems supplied through a separate service connection.

- G. Connection Assessments.** The waterworks owner is responsible for identifying all connections that require containment. The owner shall perform an assessment of the cross connection potential of all consumers' water supply systems. The assessment should be performed annually at connections likely to change classifications. Assessments do not necessarily require an on-site inspection based on a right to enter. The assessments may be performed by voluntary inspection, interviews, or questionnaires.

Interviews (on site or by phone) are one means of identifying and evaluating the need for containment. Inspections or surveys within a building are beyond the jurisdiction of VDH and are voluntary on the part of the building owner. The need to educate the building owner on the hazards of cross connections may result in a request to survey the building. A building survey may result in point-of-use isolation protection in lieu of a containment device.

A questionnaire may be substituted for the interviews. The initial assessment or follow-up assessments can be conducted through mailings. As a minimum, those facilities listed in the *Waterworks Regulations* 12 VAC 5-590-610E. should be initially interviewed.

- H. Backflow Prevention Device Testers.** Historically, the qualifications of testers have been up to each locality. Recent legislation will result in statewide device tester certification.

The rationale for certified testers is that all backflow prevention devices will eventually fail operational testing. Devices require periodic maintenance and repair. Repair parts including shutoff valves, o-rings, lubricants, etc., must be those provided by the device manufacturer or specialty companies providing manufacturers' repair kits in order to maintain approved status.

- I. Residential Containment.** Some localities require residential "containment" devices at each residential connection, either through their cross connection control program or through a residential containment program administered by their building official's office. The device most often required is a low hazard (at best) dual check valve (see 12 VAC 5-590 - 620C.) at the water meter (often integral to the meter setter). These devices are not of a type approved for containment under the *Waterworks Regulations* or OWP policy. The *Waterworks Regulations* do not provide a basis for requiring such programs.

OWP does not encourage residential contaminant programs. When a backflow hazard exists at a residence, an appropriate containment device should be required. The waterworks owner has the option to substitute isolation for containment. Residential containment with dual checks is not a substitute for an effective, active, ongoing program but can provide protection in addition to such a program.

IV. Special Regulatory Considerations.

- A. Oversight.** The evaluation of cross connection programs during either groundwater or surface water treatment plant sanitary surveys can be conducted by environmental engineers or inspectors. The review of the program records should indicate what types of facilities are being assessed by interview or by questionnaire, and what facilities are providing point-of-use isolation in lieu of containment. Once an approved cross connection control program is in place and the waterworks owner has accepted responsibility for cross connection control, the program as approved should eliminate any gray areas.

- B. Nontransient Noncommunity Waterworks.** Attached is a model program for NTNCs. Generally, any correspondence, including sanitary survey reports, regarding cross connection control should be copied to the local building official.

Nontransient noncommunity (NTNC) waterworks which do not have an approved cross connection control program and do not have a "standard" distribution system present special problems in the area of cross connection control jurisdiction. Plumbing inside the facility generally should be in compliance with the *USBC* and our jurisdiction generally ends at a service connection outside a building.

However, the waterworks owner is required to have a cross connection control program. Also, there is the shared responsibility between the waterworks owner and building owner for the quality of the water delivered to the last plumbing fixture. The responsibility for protecting the public health or abating or controlling cross connections clearly lies with the waterworks owner/building owner when they are one and the same.

- C. Privately Owned Community Waterworks.** Privately owned waterworks do not have the ability to enact ordinances to support their cross connection control programs. They must rely on their contract with their customers. Due to the wide variation in size, technical ability, and administrative ability among such waterworks, a single model program for them is not possible. Appropriate elements of the general model program

should be selected and modified as needed to tailor a program for each such waterworks on a case-by-case basis.

- V. Special Design Problems.** Advice derived from years of addressing backflow prevention problems is provided in this section. The advice and guidance included in this is to be considered independent of any decision concerning application of a containment policy and may, in fact, relate to matters totally outside our jurisdiction. This material is specifically included in this document to avoid the loss of this valuable experience. Containment devices should be required for premises with high hazard conditions.

A. Fire Protection Systems.

Health Hazard: The potential for a high degree of hazard exists when potable water quality is allowed to deteriorate due to stagnation, exposure to nonpotable water pipe, exposure to chemical antifreezes or fire retardants, or exposure to water from unapproved auxiliary sources.

Method of Backflow: Where an auxiliary connection is possible, elevated storage tanks exist, or pumps are utilized, backflow by backpressure is possible, otherwise backflow by backsiphonage is possible.

Appropriate Backflow Protection: Containment of a high hazard situation requires an air gap or a reduced pressure principle backflow prevention (RPZ) device.

All unmetered fire service connections should be fitted with a detector type device. The detector feature integral to the assembly consists of a bypass line with a smaller backflow prevention device of the same type and a water meter capable of accurately measuring a flow rate up to a minimum of 3 gpm and registering all flow rates above 3 gpm. The detector feature will indicate, by meter readings, leaks or unauthorized use of the water.

B. Lawn Sprinklers or Irrigation Systems.

Health Hazard: When the openings are subject to contamination from soil, flooding, chemicals, animals, etc., or when potable water quality is allowed to deteriorate due to stagnation or exposure to nonpotable water pipe, a health hazard exists; therefore, a high hazard exists.

Method of Backflow: Where chemical addition is by metering pump, backflow by backpressure is possible. Where chemical addition is not practiced or chemical addition is by aspiration, backflow by backsiphonage is possible.

Appropriate Backflow Prevention: Based on the degree of hazard, lawn sprinkler or irrigation systems should be protected by an atmospheric (AVB) or pressure vacuum breaker (PVB) or by a reduced pressure principle backflow prevention (RPZ) device where backpressure is a method of backflow (see Isolation Device Application Table).

AVB - backsiphonage protection without any downstream valves, with or without chemical addition by aspiration downstream of the device

PVB - backsiphonage protection with valves downstream, with or without chemical addition by aspiration downstream of the device

RPZ - backpressure and backsiphonage protection, with chemical addition by a metering pump downstream of the device.

C. Boilers.

Health Hazard: Water quality in a boiler is no longer protected from contamination. Potable water may become unfit for human consumption and/or is in contact with nonpotable materials, these waters may be chemically, biologically, or otherwise contaminated or polluted which would constitute a health hazard, therefore, a high hazard exists.

Method of Backflow: Where high temperature and/or high pressure boilers or boilers running under uncontrolled conditions (without adequate check valves) are installed, backflow by backpressure is possible.

Appropriate Backflow Prevention: Based on the degree of hazard, boilers should be protected by an air gap or RPZ device. Consult with the local building official for protection on low temperature, residential heating boilers.

D. Heat Exchangers.

Health Hazard: Same as boilers.

Method of Backflow: Same as boilers.

Appropriate Backflow Prevention - Based on the degree of hazard, heat exchangers should have an air gap or RPZ device on the potable waterline and should maintain a physical separation between the two fluids. Where a transfer fluid other than potable water is used, double-wall construction, should be used. The opening between the double walls should be drained to the atmosphere.

E. Unapproved Auxiliary Water Sources.

Health Hazard: The presence of such water sources of unknown quality outside the normal control and monitoring of a waterworks present a potential health hazard, and therefore, a high degree of hazard.

Method of Backflow: Due to lack of control, the method of backflow may be by backsiphonage or backpressure.

Appropriate Backflow Prevention: Based on their high degree of hazard, individual well or spring supplies or other unapproved auxiliary water sources shall be physically disconnected from the house or building plumbing. Abandonment of the auxiliary source is not necessary. Lines from the auxiliary source should not enter the house or building but may be used outside.

A premises where an auxiliary water source exists must be included in the cross connection program as a facility needing annual assessment.

F. Weepholes.

Definition: A weephole is a small drilled hole in the side or bottom of a device or fixture (such as a fire hydrant or blowoff) intended to drain the portion of the device subject to freezing.

Health Hazard: Appurtenances with weepholes are subject to contamination when installed in areas subject to high groundwater, to flooding, to contaminant or pollutant spills, or in areas where surface water ponds. These appurtenances used in these circumstances without adequate backflow protection would constitute a health hazard, therefore, a high hazard could exist.

Method of Backflow: Backflow by backsiphonage is possible.

Appropriate Backflow Protection: Weepholes subject to contamination are not acceptable. Alternative One in V. G. below could be considered. In situations where no reasonable alternative exists, the weephole must be plugged and the equipment marked for seasonal dewatering.

Note: The installation/testing specifications for fire hydrants should require field verification of the groundwater elevation and surface water drainage by the engineer prior to placement of the fire hydrant.

G. Frost Free Yard Hydrants and Drinking Fountains.

Health Hazard: Yard hydrants and drinking fountains with barrels or risers that drain through an underground weephole are subject to contamination when installed in areas subject to high groundwater, to flooding, to contaminant or pollutant spills, or in areas where surface water ponds. These fixtures used without adequate protection would constitute a health hazard, therefore, a high hazard exists.

Method of Backflow: Backflow by backsiphonage is possible.

Appropriate Backflow Prevention: Sanitary, frostproof yard hydrants and drinking fountains are preferred. Yard hydrant or drinking fountain alternative one or yard hydrant alternative two, listed below, could be used instead of the sanitary model. The sanitary feature includes a reservoir below the frost line to contain the drainage from the hydrant barrel or fountain riser and a venturi to return the drainage to the outlet upon next usage. The manufacturer's specified flow rate must be achieved at next usage to complete the aspiration.

Although not USC or ASSE approved (as of February 1998, ASSE 1057, Sanitary Yard Hydrants standard is being developed), sanitary, frostproof, self-draining yard hydrants with an internal atmospheric-type vacuum breaker are acceptable as being both sanitary and backsiphonage backflow protected. Most yard hydrants of this type are fitted with an internal vacuum breaker, therefore, a hose bib vacuum breaker (which may prevent draining) is not necessary.

Alternative One:

Use a standard frostproof yard hydrant or drinking fountain with the weephole drainage piped to drain to daylight where the pipe will not be subject to contamination. The pipe end must be screened. The yard hydrant should have a hose connection vacuum breaker (ASSE 1011).

Alternative Two:

A less desirable yard hydrant alternative is to install an RPZ on the line to the yard hydrant and tag the hydrant "nonpotable - do not drink."

H. Booster Pumps

Health Hazard: Booster pumps have the potential for impairing the quality of the water delivered to the consumer where unprotected cross connections exist, therefore, a potential health hazard exists and the degree of hazard would be high.

Methods of Backflow: Backflow by backsiphonage can occur if the suction side of a pump goes subatmospheric. Also, backflow by backpressure can occur from a drop in pressure in a potable water system resulting in the potable system pressure to be less

than the pressure in a nonpotable system. Under this condition, with potable and nonpotable systems linked together without adequate backflow protection, backflow will occur. Backflow may occur in a distribution system subsystem at an elevation higher than the booster pump elevation even though the suction side pressure at the booster pump station is greater than 10 or even 20 psi.

Appropriate Backflow Prevention: Individual booster pumps, distribution system booster pumps and fire service booster pumps shall be fitted with a low pressure cutoff switch set no lower than 10 psi, in accordance with 12 VAC 5-590-610D and 12 VAC 5-590-1050 A3.

These low pressure cutoff switches and their settings should be considered backflow prevention devices and should become part of the cross connection control program annual assessment of devices.

Note: Knowledge of distribution hydraulics, especially at the critical elevations within each pressure zone, is necessary to establish and maintain low pressure cutoff switch set points to prevent backflow.

I. Winterization Systems.

Health Hazard: Systems which automatically replace the water in household plumbing with antifreeze chemicals would constitute a potential health hazard due to the possibility of cheaper hazardous nonfood grade antifreeze chemicals being used, therefore, a high degree of hazard exists.

Method of Backflow: Automatic replacement of the water with antifreeze is accomplished with a pump, therefore, backflow by backpressure is possible. Backflow from the antifreeze solution tank by backsiphonage is possible due to the direct connection of the solution tank to the potable water supply.

Appropriate Backflow Prevention: Based on the degree of hazard, automatic winterization systems should be contained by an RPZ device at the service connection. Alternatively, the more conventional approach of manual winterization should be used. Upon removal of the water meter, the household plumbing can be drained or water removed with compressed air.

J. Fluoride Feed Systems.

Health Hazard: High concentrations of fluoride (>> 4.0 mg/l) constitute a health hazard, therefore, a high degree of hazard exists.

Method of Backflow: Backflow may occur by backsiphonage of fluoride solution from a saturator or solution tank into the make up water supply line or from the fluoride chemical vessel through the metering pump into the treatment train.

Appropriate Backflow Prevention:

An air gap should always be the first option evaluated. Also, where several solution feeders are connected to a common make-up water supply line that terminates at the last feeder, one spill resistant pressure vacuum breaker located at least 6-inches above the highest downstream opening or outlet would be sufficient.

upflow saturators	vacuum breaker on water supply line downstream of solenoid valve - atmospheric type vacuum breaker upstream of solenoid valve - pressure type vacuum breaker, preferably a spill resistant type
solution feed tanks	makeup water inlet submerged - vacuum breaker on water supply line downstream of solenoid valve - atmospheric vacuum breaker upstream of solenoid valve - pressure type vacuum breaker, preferably a spill resistant type (see Device Application Table)
metering pumps	all metering pump feed lines shall be provided with an antisiphon device suitable for use with the fluoride chemical being fed

K. Mobile Hazards.

Health Hazard: Cross connection control for mobile hazards such as construction site water meters, lawn care or exterminator applicator tankers, or swimming pool or cistern tankers is part of the waterworks owner's total responsibility to protect the drinking water distribution system from these potential health hazards which constitute a high degree of hazard.

Method of Backflow: Backflow could occur by backpressure or by backsiphonage from these containers.

Appropriate Backflow Prevention: The contractor meter unit must include an RPZ device to adequately protect the waterworks by containment. An air gap fitting needs to be an integral part of the fill hole of any tanker being filled from the distribution system with potable water.

Note: Routine filling of tanks should be through a connection designed for frequent use. Fire hydrants are not intended for frequent use. Opening and closing hydrants with open weepholes may loosen the foundation material which could result in the hydrant breaking away from its tee. If fire hydrants are used, a flow control valve should be used instead of using the hydrant valve to control flow.

L. Chlorinator Solution Piping.

Health Hazard: 12 VAC 5-590-1000 C10 of the *Waterworks Regulations* requires any or all chlorinators be arranged to provide pre- or post-chlorination. The method commonly used has been dual chlorinators, injectors and rotameters with crossovers which provide pre- or post-chlorination with any single component out of service.

The crossovers result in a cross connection between the raw waterline and the clearwell through the solution rotameters and crossover valves. High concentrations of chlorine (>>15 mg/l) or raw water entering the clearwell constitute a health hazard, therefore, a high hazard exists.

Method of Backflow: Backflow by backpressure could occur after plant shut down due to the hydraulic gradeline differential between the raw waterline and the clearwell. Backflow by backpressure would be more likely if the chlorinator water supply was off while the raw water pumps were on.

Appropriate Backflow Prevention: The potential for backflow and contamination exists at some water treatment plants. Steps should be taken to prevent backflow.

Possible solutions would be the elimination of solution crossovers, provision of spare parts and standby equipment components mounted or in storage (12 VAC 5-590-1000 C3), or provision of an air gap at the pre-chlorine application point.

Backflow prevention can easily be accomplished by eliminating crossovers and locating an RPZ on the solution waterline (potable waterline) going to the raw water chlorinator. Where pre- and post-chlorination system solution feed line is split just prior to the chlorine gas injector, only one RPZ on the pre-chlorine side is necessary.

An air gap at a flash mix application point would reduce initial mixing of the chlorine solution and subject the solution line to freezing.

The preferred method is an RPZ on the raw water solution feed and provision of spare parts and standby equipment. In any event, compliance with 12 VAC 5-590-1000 C10 must not result in a cross connection.

M. Post Mix Beverage Machines

Health Hazard: A typical post mix beverage system consists of a potable water connection, booster pump, carbonation tank, carbon dioxide cylinder, syrup containers, cooling system, and beverage dispenser. A pressure reducing valve and cartridge filters located between the water supply connection and booster pump may also be included in the system. The gas cylinder is generally delivered pressurized to 90 psi, and the booster pump develops in excess of 150 psi to facilitate carbonation in the carbonation tank. Where cartridge filters are present, they may become a medium for bacteriological regrowth. The release of carbon dioxide into the consumer's water supply system or to the distribution system could result in high concentrations of metals, especially copper. Either bacteriological contamination or high concentrations of copper would constitute a health hazard, therefore a high hazard exists.

Method of Backflow: Backflow by backsiphonage or by backpressure caused by either the pump or the cylinder pressure is possible.

Appropriate Backflow Prevention: Based on the high degree of hazard and methods of backflow, post mix beverage machines should be protected by an air gap or an RPZ device.

VI. Engineering Considerations.

A. Thermal Expansion.

Normally, as water is heated and expands, it backs up in the service line and into the water main, assuming no usage is occurring. Installation of containment type backflow prevention devices or certain plumbing appurtenances (pressure reducing valves) at the service connection or within the consumer's water supply system prevent thermally expanded water from flowing from the premises into the distribution system equalizing the pressure differential. When a water heater is operating, water is expanding and pressure is increasing, thermal expansion in a closed plumbing system under no flow conditions may cause the emergency temperature and pressure (T & P) relief valve to open and close frequently and may also reduce the life of plumbing fixtures and piping.

T & P relief valve is an emergency relief valve, not an operating control valve. If the T & P relief valve is used frequently, its useful life will be shortened and it could cease to function properly.

Thermal expansion can cause damaging stress and strain to water heaters, solenoid valves, O-rings, float valves, pump seals, and plumbing fixtures or fittings.

Generally, 80 psi for a short period of time is the maximum pressure under no flow conditions most fixtures, appliances or appurtenances should be subjected to (per the USBC).

Where thermal expansion is a problem the following devices could be installed:

1. a bladder or diaphragm type thermal expansion tank;
2. an auxiliary pressure relief valve;
3. an anti-siphon ball cock with auxiliary relief valve into the toilet tank set at no more than 80 psi.

Installation should be in strict accordance with the manufacturer's instructions, the Uniform Statewide Building Code and the National Sanitation Foundation.

Customers must be advised by the owner of the potential for thermal expansion prior to or during installation of a containment type backflow prevention device. Solutions to thermal expansion will generally be at the discretion of the consumer's water supply system owner and are usually at the expense of the consumer's water supply system owner.

B. Other Considerations.

- RPZ differential pressure relief port discharge rate must be considered in sizing the drain line. Since the discharge line must be air gapped from the device, gravity flow conditions occur in the line carrying the RPZ discharge.
- Pressure loss through containment devices at design flow rate must be taken into consideration, especially where pressures are marginal whether at a service connection or on a chlorinator system. USC provides manufacturers of USC approved devices with documented flow curves. These curves should be used where pressures are marginal.
- Pressure loss in residential dual checks must be considered in evaluating 20 psi under all conditions of flow at the service connection. USC documented flow curves are not available. Pressure loss impact can be significant especially in hilly terrain. If pressure is not available, residential containment cannot be universally applied.
- Where water service cannot be interrupted for device testing, overhaul, replacement, etc., two devices in parallel are necessary. Either device must be capable of meeting the total demand - not one-half of the demand.
- Fire suppression systems being retrofitted with an RPZ device will generally reduce the available fire flow. However, past fire suppression design standards were very conservative and generally resulted in an over designed system. In any event, the retrofitted fire suppression system will require recertification to verify adequate capacity and/or code compliance.
- Specifications for containment devices included in waterworks construction permit applications should require USC devices approved for containment at the time of installation and should require verification of approval status at the end of the warrant period. USC continuously verifies compliance with their specifications by a three year renewal of approval and where problems occur in the field or noncompliance is determined may rescind approval.

Attachments:

- A. Isolation Device Application Table
- B. Community Waterworks
Model Ordinance
Cross Connection Control
- C. Community Waterworks
Model Program
Cross Connection Control
- D. Nontransient Noncommunity Waterworks
Model Program
Cross Connection Control

Isolation Device Application

Degree of hazard	Method of backflow	Pressure or flow conditions	Device	ASSE #
High	BP or BS	Continuous	RPZ	1013 & 1047
	BS only	Noncontinuous	Pipe applied AVB	1001 & 1035
		Noncontinuous	Hose bibb AVB	1011 & 1052
		Noncontinuous	Wall Hydrant w/AVB	1019
		Continuous	PVB	1020 & 1056
Moderate	BP or BS	Continuous	DG-DC	1015 & 1048
Low	BS only		Dual Check:	
		Continuous	w/o vent	1024 & 1032
		Continuous	w/vent	1012

NOTES:

- Degree of Hazard - See *Table 2.10 — Determination of Degree of Hazard* in the *Waterworks Regulations*.
- BS means backflow by backsiphonage.
- BP means backflow by backpressure or superior pressure.
- Continuous means operating under continuous flow or pressure. This condition usually applies to devices installed inline and may have valves downstream of the device.
- Noncontinuous means operating intermittently not to exceed 12 hours under continuous pressure or flow in a 24-hour period. This condition usually applies to devices which are connected to hose bibbs, hydrants, or faucets which are open to the atmosphere. Valves should not be located downstream of the device.
- RPZ means a reduced pressure principal backflow prevention assembly.
- Pipe applied AVB means an atmospheric vacuum breaker permanently installed in the plumbing or on faucets.
- Hose bibb AVB means a hose bibb type atmospheric vacuum breaker with a single or with dual checks and a vent.
- Wall hydrant w/AVB means a through-the-wall, frostproof self-draining type wall hydrant with AVB attached or built in.
- PVB means a pressure vacuum breaker.
- Spill resistant AVB have the same ASSE # as standard, pipe applied AVB.
- Spill resistant PVB have ASSE # 1056.
- DG-DC means a double gate-double check valve assembly.
- Dual Check without a vent means a device composed of two independently acting check valves ("residential dual check" and "beverage dispenser dual check").
- Double check with a vent means a device composed of two independently acting check valves with an intermediate atmospheric vent ("boiler dual check").

INFORMATION:

- Yard hydrants which are frostproof and drain the water in the barrel through an underground weephole are subject to contamination and are prohibited.
- Some wall hydrants will not drain if the hose is left connected.

Remember, that application of point-of-use isolation protection beyond the service connection is beyond the jurisdiction of the VDH. The owner should be advised to consult with his Local Building Official. Written correspondence addressing cross connection control should be copied to the Local Building Official.

COMMUNITY WATERWORKS
MODEL ORDINANCE
CROSS CONNECTION CONTROL

I. Purpose of the Ordinance

Purpose of this ordinance is to abate or control actual or potential cross connections and protect the public health. This ordinance provides for establishment and enforcement of a program of cross connection control and backflow prevention in accordance with the Commonwealth of Virginia, State Board of Health, *Waterworks Regulations* 1995, or as amended. **THIS ORDINANCE IS DIRECTED AT SERVICE LINE PROTECTION (CONTAINMENT).**

II. Authority for Ordinance

Commonwealth of Virginia, Department of Health
Waterworks Regulations, Part II, Article 3:
Cross Connection Control and Backflow Prevention in Waterworks

III. Administration of the Ordinance

- A. The ____ (**Note 1**) shall administer and enforce the provisions of this ordinance under the direction of the (**Town Manager, County Administrator, Mayor, or other chief administrative officer**).
- B. It shall be the duty of the ____ (**Note 1**) to cause assessment to be made of properties served by the waterworks where cross connection with the waterworks is deemed possible. The method of determining potential cross connection with the waterworks and the administrative procedures shall be established by the ____ (**Note 1**) in a Cross Connection Control Program (Program) approved by the Commonwealth of Virginia, Department of Health, Division of Water Supply Engineering.
- C. The responsibility to carry out the Program lies with ____ (**Note 2**).

IV. Enforcement of the Ordinance

- A. Upon request, the owner or occupants of property served shall furnish to the ____ (**Note 2**) pertinent information regarding the consumer's water supply system or systems on such property for the purpose of assessing the consumer's water supply system for cross connection hazards and determining the degree of hazard, if any. The refusal of such information, when requested, shall be deemed evidence of the presence of a high degree of hazard cross connection.

B. Notice of Violation

Any consumer's water supply system owner found to be in violation of any provision of this ordinance shall be served a written notice of violation sent certified mail to the consumer's water supply system owner's last known address, stating the nature of the violation, corrective action required and providing a reasonable time limit, not to exceed 30 days, from the date of receipt of the notice of violation, to bring the consumer's water supply system into compliance with this ordinance or have water service terminated.

C. Penalties

Any owner of properties served by a connection to the waterworks found guilty of violating any of the provisions of this ordinance, or any written order of the **(Town Manager, County Administrator, Mayor, or other chief administrative officer)** in pursuance thereof, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punished by a fine of not less than (\$____) or more than (\$____) for each violation. Each day upon which a violation of the provisions of this act shall occur shall be deemed a separate and additional violation for the purposes of this ordinance.

V. **Responsibilities of the Town of _____(Note 3), _____ (Note 1), and _____ (Note 2)**

Effective cross connection control and backflow prevention requires the cooperation of the **Town of _____(Note 3), _____ (Note 1), _____ (Note 2)**, the owner(s) of the property served, the Local Building Official **(Note 4)** and the backflow prevention device tester.

- A. The Program shall be carried out in accordance with the Commonwealth of Virginia, State Board of Health, *Waterworks Regulations* and shall as a minimum provide containment of potential contaminants at the consumer's service connection.
- B. The **Town of _____** has full responsibility for water quality and for the construction, maintenance and operation of the waterworks beginning at the water source and ending at the service connection.
- C. The owner of the property served and the **Town of _____** have shared responsibility for water quality and for the construction, maintenance, and operation of the consumer's water supply system from the service connection to the free flowing outlet.
- D. The _____ **(Note 1)** shall, to the extent of their jurisdiction, provide continuing identification and evaluation of all cross connection hazards. This shall include an assessment of each consumer's water supply system for cross connections to be followed by the requirement, if necessary, of installation of a backflow prevention device or separation. Assessments shall be performed at least annually.

- E. In the event of the backflow of pollution or contamination into the waterworks, the _____ (**Note 1**) shall promptly take or cause corrective action to confine and eliminate the pollution or contamination. The _____ (**Note 1**) shall report to the appropriate Commonwealth of Virginia, Department of Health, Office of Water Programs Field Office in the most expeditious manner (usually by telephone) when backflow occurs and shall submit a written report by the 10th day of the month following the month during which backflow occurred addressing the incident, its causes, effects, and preventative or control measures required or taken.
- F. The _____ (**Note 1**) shall take positive action to ensure that the waterworks is adequately protected from cross connections and backflow at all times. If a cross connection exists or backflow occurs into a consumer's water supply system or into the waterworks or if the consumer's water supply system causes the pressure in the waterworks to be lowered below 10 psi gauge, the _____ (**Note 1**) may discontinue the water service to the consumer and water service shall not be restored until the deficiencies have been corrected or eliminated to the satisfaction of the _____ (**Note 1**).
- G. In order to protect the occupants of a premises, _____ (**Note 2**) should inform the consumer's water supply system owner(s) of any cross connection beyond the service connection that should be abated or controlled by application of an appropriate backflow prevention device or separation. Appropriate backflow prevention device or separation should be applied at each point-of-use and/or applied to the consumer's water supply system, isolating an area which may be a health or pollutional hazard to the consumer's water supply system or to the waterworks.
- H. Records of backflow prevention devices, separations, and consumer's water supply systems, including inspection records, records of backflow incidents, and records of device tests shall be maintained by _____ (**Note 1**) for ten years.

VI. Responsibilities of the Consumer's Water Supply System Owner

- A. The consumer's water supply system owner(s), at their own expense, shall install, operate, test, and maintain required backflow prevention devices or backflow prevention by separations.
- B. The consumer's water supply system owner(s) shall provide copies of test results, maintenance records and overhaul records to the _____ (**Note 1**) within 30 days of completion of testing or work. Such testing or work shall have been performed by device testers which have obtained a certificate of completion of a course recognized by the American Water Works Association, the Virginia Department of Health or the Virginia Cross Connection Control Association for cross connection control and backflow prevention inspection, maintenance and testing or otherwise be certified by a Commonwealth of Virginia tradesman certification program.

- C. All new residential service connections shall be fitted with a residential dual check (ASSE #1024). **(Note 6, residential containment is optional).**
- D. All existing residential service connections shall be fitted with a residential dual check (ASSE #1024) by (date)____ **(Note 8 for location of device).**

VII. Preventative and Control Measures for Containment

A. Service Line Protection

Backflow prevention device or separation shall be installed at the service connection to a consumer's water supply system where, in the judgment of the _____ **(Note 1)** a health or pollutional hazard to the consumer's water supply system or to the waterworks exists or may exist unless such hazards are abated or controlled to the satisfaction of the _____ **(Note 1)**

B. Special Conditions

- 1. When, as a matter of practicality, the backflow prevention device or separation cannot be installed at the service connection, the device or separation may be located downstream of the service connection but prior to any unprotected takeoffs.
 - 2. Where all actual or potential cross connections can be easily correctable at each point-of-use and where the consumer's water supply system is not intricate or complex, point-of-use isolation protection by application of an appropriate backflow prevention device or backflow prevention by separation may be used at each point-of-use in lieu of installing a containment device at the service connection.
- C. A backflow prevention device or backflow prevention by separation shall be installed at each service connection to a consumer's water supply system serving premises where the following conditions exist:
- 1. Premises on which any substance is handled in such a manner as to create an actual or potential hazard to a waterworks (this shall include premises having auxiliary water systems or having sources or systems containing process fluids or waters originating from a waterworks which are no longer under the control of the waterworks owner).
 - 2. Premises having internal cross connections that, in the judgment of the _____ **(Note 1)** may not be easily correctable or intricate plumbing arrangements which make it impracticable to determine whether or not cross connections exist.

3. Premises where, because of security requirements or other prohibitions or restrictions, it is impossible or impractical to make an evaluation of all cross connection hazards.
 4. Premises having a repeated history of cross connections being established or reestablished.
 5. Other premises specified by the _____ (**Note 1**) where cause can be shown that a potential cross connection hazard not enumerated above exists.
- D. Premises having booster pumps or fire pumps connected to the waterworks shall have the pumps equipped with a pressure sensing device to shut off or regulate the flow from the booster pump when the pressure in the waterworks drops to a minimum of 10 psi gauge at the service connection.
- E. An approved backflow prevention device or backflow prevention by separation shall be installed at each service connection to a consumer's water supply system or installed under Special Conditions, Section VII.B. serving, but not necessarily limited to, the following types of facilities:
1. Hospitals, mortuaries, clinics, veterinary establishments, nursing homes, dental offices and medical buildings;
 2. Laboratories;
 3. Piers, docks, waterfront facilities;
 4. Sewage treatment plants, sewage pumping stations, or storm water pumping stations;
 5. Food and beverage processing plants;
 6. Chemical plants, dyeing plants and pharmaceutical plants;
 7. Metal plating industries;
 8. Petroleum or natural gas processing or storage plants;
 9. Radioactive materials processing plants or nuclear reactors;
 10. Car washes and laundries;
 11. Lawn sprinkler systems, irrigation systems;
 12. Fire service systems;

13. Slaughter houses and poultry processing plants;
 14. Farms where the water is used for other than household purposes;
 15. Commercial greenhouses and nurseries;
 16. Health clubs with swimming pools, therapeutic baths, hot tubs or saunas;
 17. Paper and paper products plants and printing plants;
 18. Pesticide or exterminating companies and their vehicles with storage or mixing tanks;
 19. Schools or colleges with laboratory facilities;
 20. Highrise buildings (4 or more stories);
 21. Multiuse commercial, office, or warehouse facilities;
 22. Others specified by the _____ (**Note 1**) when reasonable cause can be shown for a potential backflow or cross connection hazard.
- F. Where lawn sprinkler systems, irrigation systems or fire service systems are connected directly to the waterworks with a separate service connection, a backflow prevention device or backflow prevention by separation shall be installed at the service connection or installed under Special Conditions, Section VII.B.1.

VIII. Type of Protection Required

The type of protection required shall depend on the degree of hazard which exists or may exist.

The degree of hazard, either high, moderate, or low, is based on the nature of the contaminant; the potential health hazard; the probability of the backflow occurrence; the method of backflow either by backpressure or by backsiphonage; and the potential effect on waterworks structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of pure water.

Table 1 shall be used as a guide to determine the degree of hazard for any situation.

- A. An air gap or physical disconnection gives the highest degree of protection and shall be used whenever practical to do so in high hazard situations subject to backpressure.
- B. An air gap, physical disconnection and a reduced pressure principle backflow prevention device will protect against backpressure when operating properly.

- C. Pressure vacuum breakers will not protect against backpressure, but will protect against backsiphonage when operating properly. Pressure vacuum breakers may be used in low, moderate or high hazard situations subject to backsiphonage only.
- D. A double gate - double check valve assembly shall not be used in high hazard situations.
- E. Barometric loops are not acceptable.
- F. Interchangeable connections or change-over devices are not acceptable.

IX. Backflow Prevention Devices and Backflow Prevention by Separation for Containment

- A. Backflow prevention devices for containment include the reduced pressure principle backflow prevention assembly, the double gate - double check valve assembly, and the pressure vacuum breaker assembly.
- B. Backflow prevention by separation shall be an air gap or physical disconnection. The minimum air gap shall be twice the effective opening of a potable water outlet unless the outlet is a distance less than three times the effective opening away from a wall or similar vertical surface, in which case the minimum air gap shall be three times the effective opening of the outlet. In no case shall the minimum air gap be less than one inch.
- C. Backflow prevention devices shall be of the approved type and shall comply with the most recent American Water Works Association Standards and shall be approved for containment by the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research.
- D. Backflow prevention devices shall be installed in a manner approved by the _____ (**Note 1**) and in accordance with the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research recommendations and the manufacturer's installation instructions. Vertical or horizontal positioning shall be as approved by the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research.
- E. Existing backflow prevention devices approved by the _____ (**Note 1**) prior to the effective date of this ordinance shall, except for inspection, testing, and maintenance requirements, be excluded from the requirements of Section X. C. and D. if the _____ (**Note 1**) is assured that the devices will protect the waterworks.
- F. For the purpose of application to Special Conditions, Section VII.B.2., point-of-use isolation devices or separations shall be as specified by the _____ (**Note 1**) where reasonable assurance can be shown that the device or separation will protect the waterworks. As a minimum, point-of-use devices should bear an appropriate American

Society of Sanitary Engineering Standard Number. See the Cross Connection Control Program, Appendix A, for Isolation Device Application.

- G. Backflow prevention devices with openings, outlets, or vents that are designed to operate or open during backflow prevention shall not be installed in pits or areas subject to flooding.

X. Maintenance and Inspection Requirements

- A. It shall be the responsibility of the consumer's water supply system owner(s) to maintain all backflow prevention devices or separations installed in accordance with Section VII in good working order and to make no piping or other arrangements for the purpose of bypassing or defeating backflow prevention devices or separations.
- B. Operational testing and inspection schedules shall be established by the _____ (**Note 1**) as outlined in the Cross Connection Control Program for all backflow prevention devices and separations which are installed at the service connection or installed under Special Conditions, Section VII. The interval between testing and inspection of each device shall be established in accordance with the age and condition of the device and the device manufacturer's recommendations. Backflow prevention device and separation inspection and testing intervals shall not exceed 1 year.
- C. Backflow prevention device overhaul procedures and replacement parts shall be in accordance with the manufacturer's recommendations.
- D. Backflow prevention device testing procedures shall be in accordance with the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research, Backflow Prevention Assembly Field Test Procedure and the manufacturer's instructions.

XI. Definitions

Air Gap — means the unobstructed vertical distance through the free atmosphere between the lowest point of the potable water outlet and the rim of the receiving vessel.

Auxiliary Water System — means any water system on or available to the premises other than the waterworks. These auxiliary waters may include water from a source such as wells, lakes, or streams; or process fluids; or used water. They may be polluted or contaminated or objectionable, or constitute an unapproved water source or system over which the water purveyor does not have control.

Backflow — means the flow of water or other liquids, mixtures, or substances into a waterworks from any source or sources other than its intended source.

Backflow Prevention by Separation ("Separation") — means preventing backflow by either an air gap or by physical disconnection of a waterworks by the removal or absence of pipes, fittings, or fixtures that connect a waterworks directly or indirectly to a nonpotable system or one of questionable quality.

Backflow Prevention Device ("Device") — means any approved device intended to prevent backflow into a waterworks.

Backpressure Backflow — means backflow caused by pressure in the downstream piping which is superior to the supply pressure at the point of consideration.

Backsiphonage Backflow — means backflow caused by a reduction in pressure which causes a partial vacuum creating a siphon effect.

Consumer — means person who drinks water from a waterworks.

Consumer's Water Supply System ("Consumer's System") — means the water service pipe, water distributing pipes, and necessary connecting pipes, fittings, control valves, and all appurtenances in or adjacent to the building or premises.

Containment — means the prevention of backflow into a waterworks from a consumer's water supply system by a backflow prevention device or by backflow prevention by separation at the service connection.

Contaminant — means any objectionable or hazardous physical, chemical, biological, or radiological substance or matter in water.

Cross Connection — means any connection or structural arrangement, direct or indirect, to the waterworks whereby backflow can occur.

Degree of Hazard — means either a high, moderate or low hazard based on the nature of the contaminant; the potential health hazard; the probability of the backflow occurrence; the method of backflow either by backpressure or by backsiphonage; and the potential effect on waterworks structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of pure water.

Distribution Main — means a water main whose primary purpose is to provide treated water to service connections.

Division — means the Commonwealth of Virginia, Virginia Department of Health, Office of Water Programs, Division of Water Supply Engineering.

Domestic Use or Usage — means normal family or household use, including drinking, laundering, bathing, cooking, heating, cleaning and flushing toilets (see Appendix A for Title 32.1, Article 2, *Code of Virginia*, 1950, as amended).

Double Gate-Double Check Valve Assembly — means an approved assembly designed to prevent backsiphonage or backpressure backflow and used for moderate or low hazard situations, composed of two independently operating, spring-loaded check valves, tightly closing shutoff valves located at each end of the assembly and fitted with properly located test cocks.

Entry Point — means the place where water from the source is delivered to the distribution system.

Health Hazard — means any condition, device, or practice in a waterworks or its operation that creates, or may create, a danger to the health and well being of the water consumer.

Isolation — means the prevention of backflow into a waterworks from a consumer's water supply system by a backflow prevention device or by backflow prevention by separation at the sources of potential contamination in the consumer's water supply system. This is also called point-of-use isolation. Isolation of an area or zone within a consumer's water supply system confines the potential source of contamination to a specific area or zone. This is called area or zone isolation.

Maximum Contaminant Level — means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a waterworks, except in the cases of turbidity and VOCs, where the maximum permissible level is measured at each entry point to the distribution system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition. Maximum contaminant levels may be either "primary" (PMCL) meaning based on health considerations or "secondary" (SMCL) meaning based on aesthetic considerations.

Plumbing Fixture — means a receptacle or device which is either permanently or temporarily connected to the water distribution system of the premises, and demands a supply of water therefrom; or discharges used water, waste materials, or sewage either directly or indirectly to the drainage system of the premises; or requires both a water supply connection and a discharge to the drainage system of the premises.

Pollution — means the presence of any foreign substance (chemical, physical, radiological, or biological) in water that tends to degrade its quality so as to constitute an unnecessary risk or impair the usefulness of the water.

Pollution Hazard — means a condition through which an aesthetically objectionable or degrading material may enter the waterworks or a consumer's water system.

Premises — means a piece of real estate; house or building and its land.

Pressure Vacuum Breaker — means an approved assembly designed to prevent backsiphonage backflow and used for high, moderate, or low hazard situations, composed of one or two independently operating, spring-loaded check valves; an independently operating,

spring-loaded air-inlet valve; tightly closing shutoff valves located at each end of the assembly; and fitted with properly located test cocks.

Process Fluids — means any kind of fluid or solution which may be chemically, biologically, or otherwise contaminated or polluted which would constitute a health, pollutional, or system hazard if introduced into the waterworks. This includes, but is not limited to:

1. Polluted or contaminated water,
2. Process waters,
3. Used water, originating from the waterworks which may have deteriorated in sanitary quality.
4. Cooling waters,
5. Contaminated natural waters taken from wells, lakes, streams, or irrigation systems,
6. Chemicals in solution or suspension, and
7. Oils, gases, acids, alkalis, and other liquid and gaseous fluid used in industrial or other processes, or for fire fighting purposes.

Pure Water or Potable Water — means water fit for human consumption and domestic use which is sanitary and normally free of minerals, organic substances, and toxic agents in excess of reasonable amounts for domestic usage in the area served and normally adequate in quantity and quality for the minimum health requirements of the persons served.

Reduced Pressure Principle Backflow Prevention Device (RPZ device) — means an approved assembly designed to prevent backsiphonage or backpressure backflow used for high, moderate, or low hazard situations, composed of a minimum of two independently operating, spring-loaded check valves together with an independent, hydraulically operating pressure differential relief valve located between the two check valves. During normal flow and at the cessation of normal flow, the pressure between these two checks shall be less than the supply pressure. The unit must include tightly closing shutoff valves located at each end of the assembly and be fitted with properly located test cocks.

Service Connection — means the point of delivery of water to a customer's building service line as follows:

1. If a meter is installed, the service connection is the downstream side of the meter;
2. If a meter is not installed, the service connection is the point of connection to the waterworks;

3. When the water purveyor is also the building owner, the service connection is the entry point to the building.

System Hazard — means a condition posing a threat of or actually causing damage to the physical properties of the waterworks or a consumer's water supply system.

Used Water — means water supplied from the waterworks to a consumer's water supply system after it has passed through the service connection.

Water Supply — means the water that shall have been taken into a waterworks from all wells, streams, springs, lakes, and other bodies of surface water (natural or impounded), and the tributaries thereto, and all impounded groundwater, but the term "water supply" shall not include any waters above the point of intake of such waterworks.

Waterworks — means a system that serves piped water for drinking or domestic use to (1) the public, (2) at least 15 connections, or (3) an average of 25 individuals for at least 60 days out of the year. The term "waterworks" shall include all structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of pure water except the piping and fixtures inside the building where such water is delivered (see Title 32.1, Article 2, *Code of Virginia*, 1950, as amended).

Waterworks Owner — means an individual, group of individuals, partnership, firm, association, institution, corporation, government entity, or the Federal Government which supplies or proposes to supply water to any person within this State from or by means of any waterworks (see Title 32.1, Article 2, *Code of Virginia*, 1950, as amended).

TABLE 1 — DETERMINATION OF DEGREE OF HAZARD

Premises with the following conditions shall be rated at the corresponding degree of hazard.

High
Hazard

- The contaminant is toxic, poisonous, noxious or unhealthy.
- In the event of backflow of the contaminant, a health hazard would exist.
- A high probability exists of a backflow occurrence either by backpressure or by backsiphonage.
- The contaminant would disrupt the service of piped water for drinking or domestic use.
- Examples — Sewage, used water, nonpotable water, auxiliary water systems and toxic or hazardous chemicals.

Moderate
Hazard

- The contaminant would only degrade the quality of the water aesthetically or impair the usefulness of the water.
- In the event of backflow of the contaminant, a health hazard would not exist.
- A moderate probability exists of a backflow occurrence either by backpressure or by backsiphonage.
- The contaminant would not seriously disrupt service of piped water for drinking or domestic use.
- Examples — Food stuff, nontoxic chemicals and nonhazardous chemicals.

Low
Hazard

- The contaminant would only degrade the quality of the water aesthetically.
- In the event of backflow of the contaminant, a health hazard would not exist.
- A low probability exists of the occurrence of backflow.
- Backflow would only occur by backsiphonage.
- The contaminant would not disrupt service of piped water.
- Examples — Food stuff, nontoxic chemicals and nonhazardous chemicals.

COMMUNITY WATERWORKS
MODEL PROGRAM
CROSS CONNECTION CONTROL

I. By Ordinance No. _____ Adopted _____

Title of Ordinance _____

II. Administration

The _____ (**Note 1**) shall administer and enforce this program under the supervision of the (**Town Manager, County Administrator, Mayor, or other chief administrative officer**).

III. Purpose

- A. Preventing backflow of pollution or contamination into the waterworks from a consumer's water supply system by installing an appropriate backflow prevention device or by backflow prevention by separation at the service connection. Containment has the highest priority.
- B. Preventing backflow of pollution or contamination into the consumer's water supply system by informing the owner of the shared responsibility for water quality and providing assistance where requested in determining the degree of hazard and recommending appropriate backflow prevention devices or separations at each point-of-use beyond the service connection which may be a health or pollutional hazard. Informing owners of the need for isolation beyond the service connection will be a continuing effort.
- C. Preventing backflow of pollution or contamination into the waterworks and into the consumer's water supply system, where it is not intricate or complex, by application of point-of-use isolation in lieu of containment. The alternative of isolation in lieu of containment will be evaluated at each premises where containment is required.

IV. Procedures

A. General

- 1. Each consumer's water supply system will be accessed at least annually for cross connection hazards. Assessment may be performed by voluntary inspections, interviews or questionnaires. Interviews may be conducted on site or by phone.

2. _____ (**Note 1**) will arrange to have trained personnel conduct an on site interview with the owner or owner's representative of each consumer's water supply system identified in Section VII C. through F., of the Ordinance.
3. _____ (**Note 1**) will arrange to have a questionnaire sent to each remaining consumer's water supply system owner or have the questionnaire completed by phone interview, including residential.
4. _____ (**Note 1**) will route all new plans for service connections to serve fire service connections and lawn sprinkler or irrigation systems and will route backflow prevention recommendations beyond the service connection through the Local Building Official.
5. The Local Building Official will coordinate cross connection control requirements at new premises, premises where usage has changed, premises where booster or fire pumps are used, and all others where plumbing modifications occur, with _____ (**Note 1**).
6. _____ (**Note 2**) will review and track the cross connection control operational verification reports and notify the consumer's water supply system owner in writing as to any testing, inspecting, and overhauling requirements 60 days prior to their annual due date.
7. Enforcement action recommendations will be submitted by _____ (**Note 1**) to the **(Town Manager, County Administrator, Mayor, or other chief administrative officer)** for approval.

B. Assessment By Interviews

1. Interviews will follow a prepared questionnaire used to assess the need for cross connection control by containment.
2. _____ (**Note 5**) will conduct a cross connection control and backflow prevention on site interview with each consumer's water supply system owner or representative identified in Section VII C. through F. of the Ordinance. During these interviews, each installed device or separation will be inspected for appropriateness, proper installation and general appearance. Point-of-use isolation protection will be discussed with the owner. A report will be filed with the _____ (**Note 1**) with violations noted and/or recommendations for repair, replacement of existing devices or separations and/or installation of additional devices.
3. Available information about the premises to be surveyed will be gathered prior to the interview.

4. The reasons for cross connection control and backflow prevention will be explained to the consumer's water supply system owner or representative.
5. Water uses after it enters the premises will be questioned.
6. Plans for future expansion and possible additional protection requirements will be discussed.
7. An inspection of the premises will be requested to determine if point-of-use isolation should be installed for the protection of the consumer's water supply system users or considered for substitution for containment.
8. All information will be recorded on the prepared questionnaire. This will include water uses, assessment of degrees of hazard and diagrams.
9. The results of the interview with recommendations for containment devices, separations and point-of-use isolation will be submitted to the _____ (**Note 1**) for approval. Recommendations for isolation devices or separation in lieu of containment will also be submitted to the Local Building Official through the _____ (**Note 1**) for approval.
10. For those facilities where phone interviews will be conducted by the _____ (**Note 5**), they will be conducted at least annually. A cross connection control questionnaire will be completed to reaffirm the degree of hazard and to assess the facility for new hazards. During these interviews, each installed device or separation will be evaluated for appropriateness, proper installation and general appearance. Point-of-use isolation protection will be discussed with the owner. A report will be filed with the _____ (**Note 1**) with violations noted and/or recommendations for repair, replacement of existing devices or separations and/or installation of additional devices.

C. Assessment By Questionnaires

1. Annual questionnaires will be sent to each consumer's water supply system owner except those premises where on site or phone interviews are being conducted.
2. The results of the annual questionnaires will be reviewed by the _____ (**Note 1**). Based on the response to the questionnaires, cross connection control interviews will be scheduled and appropriate devices or separations required to provide containment and/or point-of-use isolation where appropriate. No response to the questionnaire will prompt an on site interview. Refusal of access for inspection or provision of pertinent information shall prompt the requirement to install a high hazard containment device.
3. Questionnaires can be repeated annually at the discretion of the _____ (**Note 1**) after an initial interview at premises, including those identified in Section VII C.

through F. of the Ordinance, where devices or separations are installed and the results of the initial interview are not expected to change. These premises would be where the plumbing is not intricate or complex and not expected to be modified and no unexpected change in use of the premises would occur without __ (Note 2) being notified.

D. Consumer Notification

1. _____ (Note 1) will notify the consumer's water supply system owner in writing as to the required location of any device or separation; type of device or separation, including applicable University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USC), American Society of Sanitary Engineering (ASSE), and American Water Works Association (AWWA) approvals or standards; installation requirements; and the deadline for completing the installation - usually 15 days.
2. If the consumer's water supply system owner fails to install any required device or separation within the deadline or fails to complete testing, inspecting or overhauling as required, a Notice of Violation shall be prepared in accordance with IV.B. of the Ordinance and shall include a notification of termination of water service unless compliance is obtained within 30 days.

E. New Premises

1. All building permit applications shall be reviewed and approved by the _____ (Note 4) for cross connection control requirements prior to issuance of a building permit.
2. Required devices or separations shall be operational prior to issuance of a certificate to occupy. The initial testing of devices or verification of separations will be performed by the _____ (Note 5).
3. A follow up inspection of all premises except residential will be performed by the _____ (Note 5) within 30 days of occupancy.

F. Existing Premises

1. All owners or representatives of existing premises identified in VII C. through F. of the Ordinance will be interviewed and owners notified in writing of any backflow prevention requirements.
2. All remaining owners will initially be interviewed or mailed questionnaires.

G. Premises With Residential Containment Devices

1. Residential containment devices, such as those devices consisting of dual, independent check valves (ASSE # 1024), (shall be tested every _____ years) and shall be (overhauled) (replaced) (every _____ years) (on a schedule with the meter replacement program). (**Note 7**)
2. Annual assessment by questionnaires shall be conducted and results reviewed as noted above.

H. Premises With Individual Water Supplies

1. Premises requesting a new service connection or reconnection to the waterworks must be assessed by on site interview for cross connection hazards and the appropriate separation installed, inspected, and operational prior to making the service connection.
2. Premises with individual water supplies, i.e., an auxiliary water system, may, upon approval of the _____ (**Note 1**), maintain the water supply on the premises if a separation from the consumer's water supply system is provided and maintained and access is granted for inspections. A written request must be made and the Local Building Official concurs.
3. Annual assessments will be made to verify the maintenance of the separation. If an interview is denied, then the customer will be notified in accordance with Section IV D of the Program.

I. Premises With Booster or Fire Pumps

1. Premises having booster pumps or fire pumps connected to the waterworks shall have the pumps equipped with a pressure sensing device to shut off or regulate the flow from the booster pump when the pressure in the waterworks drops to a minimum pressure as determined by hydraulic analysis and approved by _____ (**Note 1**), not to be less than 10 psi gauge at the service connection.
2. Annual assessments will be made to verify the maintenance of the pressure sensing device. If an interview is denied, then the customer will be notified in accordance with Section IV D of the Program.

J. Backflow Prevention Device Testers

1. The tester is responsible for making competent inspections and for repairing or overhauling backflow prevention devices and making reports of such repair to the consumer's water supply system owner on forms approved by the _____ (**Note 1**)
2. The tester shall include the list of materials or replacement parts used and insure that parts used in the repair of the backflow prevention device meet the

manufacturer's recommendations and the University of Southern California, Foundation for Cross Connection Control and Hydraulic Research (USC).

3. The tester shall not change the design or operational characteristics of a device during repair or maintenance without prior written approval of the consumer's water supply system owner and _____ (**Note 1**).
4. The tester shall be equipped with and be competent in the use of all the necessary tools, gauges, manometers and other equipment necessary to properly test, repair and maintain backflow prevention devices.

K. Point-of-use Isolation Protection

1. Any premises, residential, commercial, or industrial, where all actual or potential cross connections can be easily correctable at each point-of-use and where the consumer's water supply system is not intricate or complex, point-of-use isolation protection by application of appropriate backflow prevention devices or separations may be used in lieu of installing a containment device at the service connection if the following conditions are met:
 - a. The method of protection provided shall be, in the judgment of the _____ (**Note 1**), the method which best provides protection; and
 - b. The consumer's water supply system owner grants access for inspections; and makes a request in writing for point-of-use isolation protection; and
 - c. The Local Building Official concurs.
2. Devices installed under this section shall be selected from the Isolation Device Application table in Appendix A.

V. Records (Note 9)

- A. An up-to-date listing of all customers shall be maintained by the _____ (**Note 2**). The list will contain.
 - owner of premises
 - tenant
 - name of premises
 - service address
 - phone number
 - contact person
 - number of service connections
 - size of service connection
 - annual assessment by: (Interview) (mailed questionnaire)

B. An up-to-date listing of consumer's water supply system owners who have cross connection control devices (including pressure sensing devices) or separations (including separations from auxiliary or nonpotable water systems and air gaps) installed shall be maintained by the _____ (**Note 2**). The list will contain:

- owner of premises
- tenant
- name of premises
- service address
- phone number
- contact person
- location of device or separation
- device manufacturer
- device model number
- device serial number
- device size
- device ASSE number
- cross connection or pressure sensing device tested (annually) (semi annually) (quarterly)
- pressure sensing device manufacturer
- pressure sensing device model number
- pressure sensing device serial number
- pressure sensing device pressure set point
- type of separation
 - air gap
 - physical disconnection
- separation verified (annually) (semiannually) (quarterly)
- type of protection
 - containment
 - containment and isolation
 - isolation in lieu of containment
- access (granted) (denied) (not necessary)

C. Cross connection control interview reports shall be maintained by the _____ (**Note 2**) for 10 years. The report will contain:

- inventory information as noted in section V.A. & B. above
- an assessment of:
 - degree of hazard
 - appropriateness of device or separation
 - installation acceptable
 - general condition of device or separation
 - repair/replacement recommendations
 - new/additional device or separation recommendations

- any indication of thermal expansion problems

See Appendix ___ for the Interview Report form

D. Cross connection control testing reports shall be maintained by the _____ (**Note 2**) for 10 years. The report will contain:

- inventory information as noted in section V.A. & B. above
- line pressure
- results of testing
- test method used
- date and signature of device tester

If repairs were made, the test report will contain:

- which parts replaced
- replacement parts used
- probable cause of test failure
- preventative measures taken

See Appendix ___ for the Testing Report form

E. Questionnaires shall be maintained by the _____ (**Note 2**) for 10 years. The questionnaire will contain:

- owner and address of residence
- occupant if different from owner
- phone number
- brief explanation of the program
- brief explanation of causes of backflow and control measures
- some likely cross connections:
 - a garden hose with its outlet submerged
 - kitchen sink spray hose with its spray head submerged
 - hand-held shower massager with its head submerged
 - garden hose used as an aspirator to spray soap or garden chemicals
 - spring, hot-tub, cistern, or swimming pool connected to the house plumbing system
 - water softeners improperly connected
- specific questions which will include but not be limited to:
 - individual wells, springs or cisterns on the property
 - pressure booster pumps
 - water storage tanks
 - water treatment systems
 - outside hose bibs used in conjunction with:
 - chemical sprayers
 - jet spray washers

- swimming pools, hot tubs, saunas, etc.
- lawn sprinkler or irrigation systems
- photographic developing
- utility sinks with hoses extending below sink rim
- animal watering troughs
- existing cross connection control devices:
 - working properly
 - leaking, noisy
 - any modifications or repairs made
 - date of last test
 - any problems with hot water tank relief valve or faucet washers not lasting very long
- also included with the questionnaire should be:
 - educational material
 - who to contact for further information
 - who to contact if contamination is ever suspected
 - a deadline to respond to the questionnaire

See Appendix ___ for the Questionnaire forms (residential & commercial)

- F. Residential containment device (ASSE #1024) overhaul or replacement reports shall be maintained by the _____ (**Note 2**) for 10 years
- The report will contain:
- inventory information as noted in section V.A. above
 - overhaul/replacement action
 - date of action

See Appendix ___ for the Residential Containment Device Report form

VI. Notification Letters

- A. On Site Interview
- B. Device Testing Due
- C. Device Repair Needed
- D. Test Results
- E. Device Required
- F. Violations
- G. Termination of Service
- H. Questionnaire Transmittal Letter
- I. Thermal Expansion Possible
- J. Verification of Individual Water Supply Separation Due

See Appendix ___ for the Notification Letters

VII. Reporting Contamination or Suspected Contamination.

The consumer's water supply system owner, **Local Building Official**, device tester or any other person should report contamination or the suspicion of contamination to any one or all of the following:

Title, organization, phone number of the following: (complete as needed)

- Town Manager, County Administrator, Mayor, or other chief administrative officer
- Local Building Official
- Waterworks Operator
- Virginia Department of Health, Office of Water Programs Field Office
- Local Health Department, Environmental Health Specialist

The _____ (**Note 2**) will be responsible for investigating reports of contamination or suspected contamination and will be responsible for notifying the appropriate Virginia Department of Health, Office of Water Programs _____ Field Office at Phone_____. A written report will be submitted by the 10th day of the month following the month during which backflow occurred addressing the incident, its causes, affects, and preventative or control measures required or taken.

VIII. Device Selection Guidelines

- A. Virginia Cross Connection Control Association — Recommended Best Practice
- B. International Plumbing Code and its Commentary
- C. EPA *Cross-Connection Control Manual*
- D. Virginia *Waterworks Regulations*
- E. AWWA M-14 Cross Connection Control Manual
- F. University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research

See Appendix A for the Isolation Device Application table

IX. Examples - Types of facilities, probable degree of hazard and type of containment device required. All containment devices shall comply with AWWA Standards and be approved for containment by USC. In high hazard situations subject to backpressure, backflow prevention by separation should be the method of choice wherever practical.

1. Hospitals, mortuaries, clinics, veterinary establishments, dental offices, nursing homes, and medical buildings: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013

2. Laboratories: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
3. Piers, docks, waterfront facilities: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
4. Sewage treatment plants, sewage pumping stations, or storm water pumping stations: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
5. Food and beverage processing plants: Generally, a moderate hazard, Double Gate—Double Check Valve Assembly (DG—DC) ASSE #1015;
Use of toxics, etc., in processing: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
6. Chemical plants, dyeing plants and pharmaceutical plants: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
7. Metal plating industries: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
8. Petroleum processing or storage plants: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
9. Radioactive materials processing plants or nuclear reactors: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
10. Car washes and laundries: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
11. Lawn sprinkler systems, irrigation systems: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013 or Atmospheric Vacuum Breakers (AVB) ASSE #1001 or Pressure Vacuum Breaker (PVB) ASSE #1020, see Appendix A, depending on method of backflow and pressure or flow conditions
12. Fire service systems: See Section VII D and F of the Ordinance
13. Slaughter houses and poultry processing plants: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
14. Farms where the water is used for other than household purposes: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
15. Commercial greenhouses and nurseries: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013

16. Health clubs with swimming pools, therapeutic baths, hot tubs or saunas: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
17. Paper and paper products plants and printing plants: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
18. Pesticide or exterminating companies and their vehicles with storage or mixing tanks: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013 at service connection and on vehicles
19. Schools or colleges with laboratory facilities: High hazard, Reduced Pressure Principle Device (RPZ) ASSE #1013
20. Highrise buildings (4 or more stories): Unless otherwise covered, Moderate hazard, Double Gate—Double Check Valve Assembly (DG—DC) ASSE #1015
21. Multiuse commercial, office, or warehouse facilities: Unless otherwise covered, Moderate hazard, Double Gate-Double Check Valve Assembly (DG - DC) ASSE #1015

X. Device Selection - shall depend on the degree of hazard which exists or may exist. Backflow prevention by separation gives the highest degree of protection and shall be used whenever practical to do so in high hazard situations subject to backpressure. See Appendix A for the Isolation Device Application table.

XI. Device Testability/Serviceability

1. Containment or isolation devices used within the consumer's water supply system that are capable of being tested and repaired in-line include the Reduced Pressure Principle Device (RPZ), Double Gate—Double Check Valve Assembly (DG—DC) & Pressure Vacuum Breaker (PVB).
2. Residential Dual Checks without an intermediate atmospheric vent and Boiler Dual Checks with an intermediate atmospheric vent are testable but most of these ASSE approved devices must be removed for testing. Some can be overhauled in-line.
3. Generally, a visual inspection is the only means to inspect most Hose Bibb Vacuum Breakers (HBVBs) since they cannot be removed if installed in accordance with the manufacturer's instructions. Some manufacturers do provide wall hydrant type HBVB with removable vacuum breakers which can be easily removed for inspection and replacement.
4. Pipe connected Atmospheric Vacuum Breakers (AVBs) can be inspected by removing the top cover.
5. Air gaps and physical disconnection require only a visual inspection.

XII. Backflow Prevention Device Tester List

See Appendix _____.

XIII. Consumer Education Literature

See Appendix _____.

XIV. Typical Installation Sketches

See Appendix _____.

XV. Thermal Expansion

Normally, as water is heated and expands it would back up in the service line into the main if no usage was occurring. Installation of backflow prevention devices or certain plumbing appurtenances (pressure reducing valves) at the service connection or within the consumer's water supply system prevent thermally expanded water from flowing from the premises into the distribution system. When the water heater is operating, water is expanding and pressure is increasing, thermal expansion in a closed plumbing system under no flow conditions may cause the emergency temperature and pressure relief valve to open and close frequently and may reduce the life of plumbing fixtures and piping.

The temperature and pressure (T & P) relief valve is an emergency relief valve, not an operating control valve. If the T & P relief valve is used frequently, its useful life will be shortened and it could cease to function.

Thermal expansion can cause damaging stress and strain to water heaters, solenoid valves, O-rings, float valves, pump seals, and plumbing fixtures or fittings.

Generally, 80 psi for a short period of time is the maximum pressure under no flow conditions most fixtures, appliances or appurtenances should be subjected to.

Where thermal expansion is a problem the following devices could be installed:

1. a bladder or diaphragm type expansion tank;
2. an auxiliary pressure relief valve;
3. an anti-siphon ball cock with auxiliary relief valve into the toilet tank set at no more than 80 psi.

Installation should be in strict accordance with the manufacturer's instructions, the Uniform Statewide Building Code and the National Sanitation Foundation.

Customers will be advised of the potential for thermal expansion prior to or during installation of a backflow prevention device. Solutions to thermal expansion will be at the discretion of the consumer's water supply system owner and at the expense of the consumer's water supply system owner.

Appendix A
Isolation Device Application

Degree of hazard	Method of backflow	Pressure or flow conditions	Device	ASSE #
High	BP or BS	Continuous	RPZ	1013 & 1047
	BS only	Noncontinuous	Pipe applied AVB	1001 & 1035
		Noncontinuous	Hose bibb AVB	1011 & 1052
		Noncontinuous	Wall Hydrant w/AVB	1019
		Continuous	PVB	1020 & 1056
Moderate	BP or BS	Continuous	DG-DC	1015 & 1048
Low	BS only		Dual Check:	
		Continuous	w/o vent	1024 & 1032
		Continuous	w/vent	1012

NOTES:

- Degree of Hazard - See *Table 1 — Determination of Degree of Hazard* in the Ordinance.
- BS means backflow by backsiphonage.
- BP means backflow by backpressure or superior pressure.
- Continuous means operating under continuous flow or pressure. This condition usually applies to devices installed inline and may have valves downstream of the device.
- Noncontinuous means operating intermittently not to exceed 12 hours under continuous pressure or flow in a 24-hour period. This condition usually applies to devices which are connected to hose bibbs, hydrants, or faucets which are open to the atmosphere. Valves should not be located downstream of the device.
- RPZ means a reduced pressure principal backflow prevention assembly.
- Pipe applied AVB means an atmospheric vacuum breaker permanently installed in the plumbing or on faucets.
- Hose bibb AVB means a hose bibb type atmospheric vacuum breaker with a single or with dual checks and a vent.
- Wall hydrant w/AVB means a through-the-wall, frostproof self-draining type wall hydrant with AVB attached or built in.
- PVB means a pressure vacuum breaker.
- Spill resistant AVB have the same ASSE # as standard, pipe applied AVB.
- Spill resistant PVB have ASSE # 1056.
- DG-DC means a double gate-double check valve assembly.
- Dual Check without a vent means a device composed of two independently acting check valves ("residential dual check" and "beverage dispenser dual check").
- Double check with a vent means a device composed of two independently acting check valves with an intermediate atmospheric vent ("boiler dual check").

INFORMATION:

- Yard hydrants which are frostproof and drain the water in the barrel through a weep hole when not in use will not drain automatically when fitted with a hose bibb AVB. Weep holes must not be subjected to contamination.
- Some wall hydrants will not drain if the hose is left connected.

Cross-connection Control Ordinance and Program

NOTES*

- NOTE 1:** The position should be the title of the director overseeing the water treatment plant and the water distribution system.
- NOTE 2:** This position should be the title of the individual that handles day-to-day activities of the water distribution system or other waterworks supervisory personnel and that has been designated as the cross connection control program supervisor.
- NOTE 3:** The purveyor is the waterworks owner as noted in past definitions. This term as used throughout the Ordinance and Program has changed to "the Town of _____" or some similar title.
- NOTE 4:** This position should be the title of the code official who conducts *Uniform Statewide Building Code* inspections.
- NOTE 5:** This position should be the title of a Town employee who has completed the Virginia Cross Connection Control Association sponsored class or equal for testing backflow prevention devices.
- NOTE 6:** Residential containment is optional. If residential containment devices are installed, the annual residential questionnaires will still be needed to ensure the low hazard residential containment devices are appropriate. The questionnaire will also be needed to identify existing premises to be fitted with a device.
- Residential connections may also be eligible for point-of-use isolation in accordance with Section VII B.2 of the Ordinance. An automatic draining, frostproof wall hydrant (ASSE 1019) is a good example of a residential, point-of-use isolation device.
- NOTE 7:** Testing, if appropriate, overhauling or replacing these devices should be as recommended by the manufacturer.
- NOTE 8:** If residential containment is adopted, all residential connections should be fitted by a target date. The location of the device is also optional. The device can be in the meter box or inside the residence. This model is written to use the meter box location.
- NOTE 9:** The following items should be provided in an appendix:

On Site Interview Report Forms
Test Forms
Questionnaires
Notification Letters
Device Selection Guidelines
Backflow Prevention Device Tester List
Consumer Education Literature
Typical installation sketches

*These notes are not intended to be part of the final documents.

NONTRANSIENT NONCOMMUNITY WATERWORKS

MODEL PROGRAM

CROSS CONNECTION CONTROL

I. Purpose of the Program

Purpose of this program is to abate or control actual or potential cross connections and protect the public health. This program provides for establishment and enforcement of a program of cross connection control and backflow prevention in accordance with the Commonwealth of Virginia, State Board of Health, *Waterworks Regulations* 1995, or as amended. **THIS PROGRAM IS DIRECTED AT A WATERWORKS WHERE THE WATERWORKS OWNER AND PREMISES OWNER IS ONE AND THE SAME (OWNER).**

II. Authority for the Program

Commonwealth of Virginia, Department of Health
Waterworks Regulations, Part II, Article 3:
Cross Connection Control and Backflow Prevention in Waterworks

III. Administration of the Program

- A. The owner shall administer and enforce the provisions of this program.
- B. It shall be the duty of the owner to cause assessment to be made of the waterworks and premises where cross connection with the waterworks is deemed possible.
- C. The responsibility to carry out the Program lies with _____, waterworks owner.

IV. Responsibilities of the Owner

Effective cross connection control and backflow prevention requires the cooperation of the owner, the local building official and the backflow prevention device tester.

- A. The Program shall be carried out in accordance with the Commonwealth of Virginia, State Board of Health, *Waterworks Regulations* and shall provide containment or isolation of potential contaminants.
- B. The owner has full responsibility for water quality and for the construction, maintenance and operation of the waterworks beginning at the water source and ending at the free flowing outlet.

- C. The owner shall, to the extent of his/her jurisdiction, provide continuing identification and evaluation of all cross connection hazards. This shall include an assessment of the water supply system for cross connections to be followed by the installation of a backflow prevention device or separation if necessary. Assessments shall be performed at least annually.
- D. In the event of the backflow of pollution or contamination into the waterworks, the owner shall promptly take or cause corrective action to confine and eliminate the pollution or contamination. The owner shall report to the appropriate Commonwealth of Virginia, Department of Health, Office of Water Programs Field Office in the most expeditious manner (usually by telephone) when backflow occurs and shall submit a written report by the 10th day of the month following the month during which backflow occurred addressing the incident, its causes, effects, and preventative or control measures required or taken.
- E. The owner shall take positive action to ensure that the waterworks is adequately protected from cross connections and backflow at all times. If a cross connection exists or backflow occurs or if the consumer's water supply system causes the pressure in the waterworks to be lowered below 10 psi gauge, the owner may discontinue the water service and water service shall not be restored until the deficiencies have been corrected or eliminated to the satisfaction of the Commonwealth of Virginia, Department of Health, Office of Water Programs Field Office.
- F. In order to protect the occupants of the premises, any cross connection beyond the service connection should be eliminated by application of an appropriate backflow prevention device or separation. Appropriate backflow prevention device or separation should be applied at each point-of-use and/or applied to the water supply system, isolating an area which may be a health or pollutional hazard to the water supply system or to the waterworks.
- G. Records of backflow prevention devices, separations, and the water supply system, including inspection records, records of backflow incidents, and records of device tests shall be maintained for ten years.

V. Type of Protection Required

The type of protection required shall depend on the degree of hazard which exists or may exist.

The degree of hazard, either high, moderate, or low, is based on the nature of the contaminant; the potential health hazard; the probability of the backflow occurrence; the method of backflow either by backpressure or by backsiphonage; and the potential effect on waterworks structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of pure water.

Table 1 shall be used as a guide to determine the degree of hazard for any situation.

- A. An air gap or physical disconnection gives the highest degree of protection and shall be used whenever practical to do so in high hazard situations subject to backpressure.
- B. An air gap, physical disconnection and a reduced pressure principle backflow prevention device will protect against backpressure when operating properly.
- C. Pressure vacuum breakers will not protect against backpressure, but will protect against backsiphonage when operating properly. Pressure vacuum breakers may be used in low, moderate or high hazard situations subject to backsiphonage only.
- D. A double gate - double check valve assembly shall not be used in high hazard situations.
- E. Barometric loops are not acceptable.
- F. Interchangeable connections or change-over devices are not acceptable.

VI. Backflow Prevention Devices and Backflow Prevention by Separation

- A. Backflow prevention devices for containment include the reduced pressure principle backflow prevention assembly, the double gate - double check valve assembly, and the pressure vacuum breaker assembly.
- B. Backflow prevention by separation shall be an air gap or physical disconnection. The minimum air gap shall be twice the effective opening of a potable water outlet unless the outlet is a distance less than three times the effective opening away from a wall or similar vertical surface, in which case the minimum air gap shall be three times the effective opening of the outlet. In no case shall the minimum air gap be less than one inch.
- C. Backflow prevention devices shall be of the approved type and shall comply with the most recent American Water Works Association Standards and shall be approved for containment by the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research.
- D. Backflow prevention devices shall be installed in a manner approved by the owner and in accordance with the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research recommendations and the manufacturer's installation instructions. Vertical or horizontal positioning shall be as approved by the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research.

- E. Point-of-use isolation devices shall bear an appropriate American Society of Sanitary Engineering Standard Number.
- F. Backflow prevention devices with openings, outlets, or vents that are designed to operate or open during backflow prevention shall not be installed in pits or areas subject to flooding.

VII. Preventative and Control Measures

A. General

- 1. All potable water openings or outlets shall be protected against backflow where a health, pollutional, or system hazard to the waterworks exists or may exist.
 - 2. The required method of protection provided shall be the method which best provides protection of health, pollution, or system hazards.
 - 3. The required device or separation shall be installed or constructed in accordance with the Uniform Statewide Building Code, the Commonwealth of Virginia State Board of Health *Waterworks Regulations*, manufacturers' recommendations and the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research (USC) as appropriate.
- B. A backflow prevention device shall be installed where the plumbing fixture connects to the premises water supply system or the waterworks, as appropriate, where the following conditions exist:
- 1. A backflow prevention device shall be installed at fire protection system connections to the premises' water supply system or to the waterworks. The protection shall be by a reduced pressure principle backflow preventer, ASSE No. 1013.
 - 2. Where fire protection systems are constructed of piping, joints and connections approved for water distribution systems (NSF pw) a backflow prevention device shall not be required if the premises' water supply system design provides freely flowing potable water through the fire protection system and the potable water is not allowed to stagnate or deteriorate in water quality; otherwise, protection shall be by a reduced pressure principle backflow preventer, ASSE #1013.
 - 3. Premises having booster pumps connected to the waterworks or water system shall be equipped with a low pressure regulating or cutoff device to shut off the booster pump when the suction pressure drops to a minimum pressure as determined by hydraulic analysis and approved by the Office of Water Programs, not to be less than 10 psi gauge.

4. At the connection to boiler systems where conditioning chemicals are or can be used, a reduced pressure principle backflow preventer (RPZ) shall be used, ASSE No. 1013 or an air gap shall be used.
5. At the connection of irrigation systems under the following conditions:
 - a. Where shutoff valves or metering pumps are not located down stream of the backflow prevention device, an atmospheric vacuum breaker, ASSE No. 1001, shall be installed and located at least 12 inches above the highest outlet or flood elevation but no more than 30 inches above the ground.
 - b. Where shutoff valves are located downstream of the backflow prevention device and metering pumps are not used, a pressure type vacuum breaker, ASSE No. 1020, shall be installed and located at least 6 inches above the highest outlet or flood elevation but not more than 30 inches above the ground.
 - c. Where metering pumps are used in the irrigation system to dispense fertilizer or other chemicals, an RPZ, ASSE No. 1013, shall be installed above ground, not in a pit or area subject to flooding.
6. Existing premises with an auxiliary water system may maintain the auxiliary system on the premises by use of backflow prevention by physical disconnection from the auxiliary water system.
7. The type of backflow prevention device listed below with corresponding ASSE Standard number shall be installed at each of the following locations:
 - a. threaded hose bibbs, hose bibb vacuum breaker 1011 or frostproof automatic draining wall hydrants 1019
 - b. laboratory faucets where hoses can be attached, vacuum breaker 1035
 - c. shampoo sinks, pressure type vacuum breaker 1020
 - d. sinks, vats, tanks, or other receptacles, air gap (See definitions)
 - e. swimming pool, hot tub, sauna, RPZ 1013
 - f. washing machines where water supply valve is located ahead of backflow prevention device, atmospheric vacuum breaker 1001
 - g. washing machines where water supply valve is located below backflow prevention device, pressure type vacuum breaker 1020

- h. garbage can washer, pressure type vacuum breaker 1020
- i. carbonated beverage dispensers post mix RPZ 1013
- j. food handling equipment
- k. liquid vending machines
- l. **Add additional locations consistent with the waterworks and the facilities served. Locations listed above which do not apply may be deleted.**
- m.
- n.

VIII. Maintenance and Inspection Requirements

- A. It shall be the responsibility of the owner to maintain all backflow prevention devices or separations in good working order and to make no piping or other arrangements for the purpose of bypassing or defeating backflow prevention devices or separations.
- B. Operational testing and inspection schedules shall be established by the owner. The interval between testing and inspection of each device shall be established in accordance with the age and condition of the device and the device manufacturer's recommendations. Backflow prevention device and separation inspection and testing intervals shall not exceed 1 year.
- C. Backflow prevention device overhaul procedures and replacement parts shall be in accordance with the manufacturer's recommendations.
- D. Backflow prevention device testing procedures shall be in accordance with the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research, Backflow Prevention Assembly Field Test Procedure and the manufacturer's instructions.

IX. Backflow Prevention Device Testers

- 1. Device testers will have obtained a certificate of completion of a course recognized by the American Water works Association, the Virginia Department of Health or the Virginia Cross Connection Control Association for cross connection control and backflow prevention inspection, maintenance and testing or otherwise be certified by a Commonwealth of Virginia tradesman certification program.

2. The tester is responsible for making competent inspections and for repairing or overhauling backflow prevention devices and making reports of such repair to the consumer's water supply system owner on forms approved by the Office of Water Programs.
3. The tester shall include the list of materials or replacement parts used and insure that parts used in the repair of the backflow prevention device meet the manufacturer's recommendations and the University of Southern California, Foundation for Cross Connection Control and Hydraulic Research (USC).
4. The tester shall not change the design or operational characteristics of a device during repair or maintenance without prior written approval of the waterworks owner and the Office of Water Programs.
5. The tester shall be equipped with and be competent in the use of all the necessary tools gauges, manometers and other equipment necessary to properly test, repair and maintain backflow prevention devices.

X. Records

- A. An up-to-date listing of waterworks and water supply system locations where cross connection control devices (including pressure sensing devices) or separations (including separations from auxiliary or nonpotable water systems and air gaps) are installed shall be maintained by the owner. The list will contain:
 - location of backflow prevention device, pressure sensing device or separation
 - manufacturer of device
 - device model number
 - device serial number
 - device size
 - ASSE number
 - device testing frequency (annually) (semiannually) (quarterly)
 - pressure sensing device pressure set point
- B. Cross connection control device or separation inspection reports shall be maintained by the owner for ten years. The report will contain:
 - information as noted in A above
 - an assessment of:
 - degree of hazard
 - appropriateness of device or separation
 - installation
 - general appearance
 - repair/replacement actions
 - new/additional device installations

C. Cross connection control device testing reports shall be maintained by the owner for ten years. The report will contain:

- information as noted in A above
- line pressure
- results of testing
- test method used
- date and signature of device tester

If repairs were made, the test report will contain:

- which parts replaced
- probable cause of test failure
- preventative measures taken

XI. Thermal Expansion

Normally, as water is heated and expands it would back up in the service line into the main if no usage was occurring. Installation of backflow prevention devices or certain plumbing appurtenances (pressure reducing valves) at the service connection or within the consumer's water supply system prevent thermally expanded water from flowing from the premises into the distribution system. When the water heater is operating, water is expanding and pressure is increasing, thermal expansion in a closed plumbing system under no flow conditions may cause the emergency temperature and pressure relief valve to open and close frequently and may reduce the life of plumbing fixtures and piping.

The temperature and pressure (T & P) relief valve is an emergency relief valve, not an operating control valve. If the T & P relief valve is used frequently, its useful life will be shortened and it could cease to function.

Thermal expansion can cause damaging stress and strain to water heaters, solenoid valves, O-rings, float valves, pump seals, and plumbing fixtures or fittings.

Generally, 80 psi for a short period of time is the maximum pressure under no flow conditions most fixtures, appliances or appurtenances should be subjected to.

Where thermal expansion is a problem the following devices could be installed:

1. a bladder or diaphragm type expansion tank;
2. an auxiliary pressure relief valve;
3. an anti-siphon ball cock with auxiliary relief valve into the toilet tank set at no more than 80 psi.

Installation should be in strict accordance with the manufacturer's instructions, the Uniform Statewide Building Code and the National Sanitation Foundation.

Customers will be advised of the potential for thermal expansion prior to or during installation of a backflow prevention device. Solutions to thermal expansion will be at the discretion of the consumer's water supply system owner and at the expense of the consumer's water supply system owner.

V. **Definitions**

Air Gap — means the unobstructed vertical distance through the free atmosphere between the lowest point of the potable water outlet and the rim of the receiving vessel.

Auxiliary Water System — means any water system on or available to the premises other than the waterworks. These auxiliary waters may include water from a source such as wells, lakes, or streams; or process fluids; or used water. They may be polluted or contaminated or objectionable, or constitute an unapproved water source or system over which the water purveyor does not have control.

Backflow — means the flow of water or other liquids, mixtures, or substances into a waterworks from any source or sources other than its intended source.

Backflow Prevention by Separation ("Separation") — means preventing backflow by either an air gap or by physical disconnection of a waterworks by the removal or absence of pipes, fittings, or fixtures that connect a waterworks directly or indirectly to a nonpotable system or one of questionable quality.

Backflow Prevention Device ("Device") — means any approved device intended to prevent backflow into a waterworks.

Backpressure Backflow — means backflow caused by pressure in the downstream piping which is superior to the supply pressure at the point of consideration.

Backsiphonage Backflow — means backflow caused by a reduction in pressure which causes a partial vacuum creating a siphon effect.

Consumer — means person who drinks water from a waterworks.

Consumer's Water Supply System ("Water Supply System") — means the water service pipe, water distributing pipes, and necessary connecting pipes, fittings, control valves, and all appurtenances in or adjacent to the building or premises.

Containment — means the prevention of backflow into a waterworks from a consumer's water supply system by a backflow prevention device or by backflow prevention by separation at the service connection.

Contaminant — means any objectionable or hazardous physical, chemical, biological, or radiological substance or matter in water.

Cross Connection — means any connection or structural arrangement, direct or indirect, to the waterworks whereby backflow can occur.

Degree of Hazard — means either a high, moderate or low hazard based on the nature of the contaminant; the potential health hazard; the probability of the backflow occurrence; the method of backflow either by backpressure or by backsiphonage; and the potential effect on waterworks structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of pure water.

Distribution Main — means a water main whose primary purpose is to provide treated water to service connections.

Division — means the Commonwealth of Virginia, Virginia Department of Health, Office of Water Programs, Division of Water Supply Engineering.

Domestic Use or Usage — means normal family or household use, including drinking, laundering, bathing, cooking, heating, cleaning and flushing toilets (see Appendix A for Title 32.1, Article 2, *Code of Virginia*, 1950, as amended).

Double Gate-Double Check Valve Assembly — means an approved assembly designed to prevent backsiphonage or backpressure backflow and used for moderate or low hazard situations, composed of two independently operating, spring-loaded check valves, tightly closing shutoff valves located at each end of the assembly and fitted with properly located test cocks.

Entry Point — means the place where water from the source is delivered to the distribution system.

Health Hazard — means any condition, device, or practice in a waterworks or its operation that creates, or may create, a danger to the health and well being of the water consumer.

Isolation — means the prevention of backflow into a waterworks from a consumer's water supply system by a backflow prevention device or by backflow prevention by separation at the sources of potential contamination in the consumer's water supply system. This is also called point-of-use isolation. Isolation of an area or zone within a consumer's water supply system confines the potential source of contamination to a specific area or zone. This is called area or zone isolation.

Maximum Contaminant Level — means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a waterworks, except in the cases of turbidity and VOCs, where the maximum permissible level is measured at each entry point to the distribution system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition. Maximum contaminant levels may be either "primary" (PMCL) meaning based on health considerations or "secondary" (SMCL) meaning based on aesthetic considerations.

Plumbing Fixture — means a receptacle or device which is either permanently or temporarily connected to the water distribution system of the premises, and demands a supply of water therefrom; or discharges used water, waste materials, or sewage either directly or indirectly to the drainage system of the premises; or requires both a water supply connection and a discharge to the drainage system of the premises.

Pollution — means the presence of any foreign substance (chemical, physical, radiological, or biological) in water that tends to degrade its quality so as to constitute an unnecessary risk or impair the usefulness of the water.

Pollution Hazard — means a condition through which an aesthetically objectionable or degrading material may enter the waterworks or a consumer's water system.

Premises — means a piece of real estate; house or building and its land.

Pressure Vacuum Breaker — means an approved assembly designed to prevent backsiphonage backflow and used for high, moderate, or low hazard situations, composed of one or two independently operating, spring-loaded check valves; an independently operating, spring-loaded air-inlet valve; tightly closing shutoff valves located at each end of the assembly; and fitted with properly located test cocks.

Process Fluids — means any kind of fluid or solution which may be chemically, biologically, or otherwise contaminated or polluted which would constitute a health, pollutional, or system hazard if introduced into the waterworks. This includes, but is not limited to:

1. Polluted or contaminated water,
2. Process waters,
3. Used water, originating from the waterworks which may have deteriorated in sanitary quality.
4. Cooling waters,
5. Contaminated natural waters taken from wells, lakes, streams, or irrigation systems,

6. Chemicals in solution or suspension, and
7. Oils, gases, acids, alkalis, and other liquid and gaseous fluid used in industrial or other processes, or for fire fighting purposes.

Pure Water or Potable Water — means water fit for human consumption and domestic use which is sanitary and normally free of minerals, organic substances, and toxic agents in excess of reasonable amounts for domestic usage in the area served and normally adequate in quantity and quality for the minimum health requirements of the persons served (see Appendix A for Title 32.1, Article 2, *Code of Virginia*, 1950, as amended).

Reduced Pressure Principle Backflow Prevention Device (RPZ device) — means an approved assembly designed to prevent backsiphonage or backpressure backflow used for high, moderate, or low hazard situations, composed of a minimum of two independently operating, spring-loaded check valves together with an independent, hydraulically operating pressure differential relief valve located between the two check valves. During normal flow and at the cessation of normal flow, the pressure between these two checks shall be less than the supply pressure. The unit must include tightly closing shutoff valves located at each end of the assembly and be fitted with properly located test cocks.

Service Connection — means the point of delivery of water to a customer's building service line as follows:

1. If a meter is installed, the service connection is the downstream side of the meter;
2. If a meter is not installed, the service connection is the point of connection to the waterworks;
3. When the water purveyor is also the building owner, the service connection is the entry point to the building.

System Hazard — means a condition posing a threat of or actually causing damage to the physical properties of the waterworks or a consumer's water supply system.

Used Water — means water supplied from the waterworks to a consumer's water supply system after it has passed through the service connection.

Water Supply — means the water that shall have been taken into a waterworks from all wells, streams, springs, lakes, and other bodies of surface water (natural or impounded), and the tributaries thereto, and all impounded groundwater, but the term "water supply" shall not include any waters above the point of intake of such waterworks (see Appendix A for Title 32.1, Article 2, *Code of Virginia*, 1950, as amended).

Waterworks — means a system that serves piped water for drinking or domestic use to (1) the public, (2) at least 15 connections, or (3) an average of 25 individuals for at least 60 days

out of the year. The term "waterworks" shall include all structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of pure water except the piping and fixtures inside the building where such water is delivered (see Title 32.1, Article 2, *Code of Virginia*, 1950, as amended).

Waterworks Owner — means an individual, group of individuals, partnership, firm, association, institution, corporation, government entity, or the Federal Government which supplies or proposes to supply water to any person within this State from or by means of any waterworks (see Title 32.1, Article 2, *Code of Virginia*, 1950, as amended).

TABLE 1 — DETERMINATION OF DEGREE OF HAZARD

Premises with one or more of the following conditions shall be rated at the corresponding degree of hazard.

High
Hazard

- The contaminant is toxic, poisonous, noxious or unhealthy.
- In the event of backflow of the contaminant, a health hazard would exist.
- A high probability exists of a backflow occurrence either by backpressure or by backsiphonage.
- The contaminant would disrupt the service of piped water for drinking or domestic use.
- Examples — Sewage, used water, nonpotable water, auxiliary water systems and toxic or hazardous chemicals.

Moderate
Hazard

- The contaminant would only degrade the quality of the water aesthetically or impair the usefulness of the water.
- In the event of backflow of the contaminant, a health hazard would not exist.
- A moderate probability exists of a backflow occurrence either by backpressure or by backsiphonage.
- The contaminant would not seriously disrupt service of piped water for drinking or domestic use.
- Examples — Food stuff, nontoxic chemicals and nonhazardous chemicals.

Low
Hazard

- The contaminant would only degrade the quality of the water aesthetically.
- In the event of backflow of the contaminant, a health hazard would not exist.
- A low probability exists of the occurrence of backflow.
- Backflow would only occur by backsiphonage.
- The contaminant would not disrupt service of piped water.
- Examples — Food stuff, nontoxic chemicals and nonhazardous chemicals.

Isolation Device Application

Degree of hazard	Method of backflow	Pressure or flow conditions	Device	ASSE #
High	BP or BS	Continuous	RPZ	1013 & 1047
	BS only	Noncontinuous	Pipe applied AVB	1001 & 1035
		Noncontinuous	Hose bibb AVB	1011 & 1052
		Noncontinuous	Wall Hydrant w/AVB	1019
		Continuous	PVB	1020 & 1056
Moderate	BP or BS	Continuous	DG-DC	1015 & 1048
Low	BS only		Dual Check:	
		Continuous	w/o vent	1024 & 1032
		Continuous	w/vent	1012

NOTES:

- Degree of Hazard - See *Table 2.10 — Determination of Degree of Hazard in the Waterworks Regulations*.
- BS means backflow by backsiphonage.
- BP means backflow by backpressure or superior pressure.
- Continuous means operating under continuous flow or pressure. This condition usually applies to devices installed inline and may have valves downstream of the device.
- Noncontinuous means operating intermittently not to exceed 12 hours under continuous pressure or flow in a 24-hour period. This condition usually applies to devices which are connected to hose bibbs, hydrants, or faucets which are open to the atmosphere. Valves should not be located downstream of the device.
- RPZ means a reduced pressure principal backflow prevention assembly.
- Pipe applied AVB means an atmospheric vacuum breaker permanently installed in the plumbing or on faucets.
- Hose bibb AVB means a hose bibb type atmospheric vacuum breaker with a single or with dual checks and a vent.
- Wall hydrant w/AVB means a through-the-wall, frostproof self-draining type wall hydrant with AVB attached or built in.
- PVB means a pressure vacuum breaker.
- Spill resistant AVB have the same ASSE # as standard, pipe applied AVB.
- Spill resistant PVB have ASSE # 1056.
- DG-DC means a double gate-double check valve assembly.
- Dual Check without a vent means a device composed of two independently acting check valves ("residential dual check" and "beverage dispenser dual check").
- Double check with a vent means a device composed of two independently acting check valves with an intermediate atmospheric vent ("boiler dual check").

INFORMATION:

- Yard hydrants which are frostproof and drain the water in the barrel through an underground weephole are subject to contamination and are prohibited.
- Some wall hydrants will not drain if the hose is left connected.